What is claimed is:

1. A constant temperature distilling process, comprising the steps of implementing a drain-to-vacuum process using a degassed liquid to set a constant temperature distillation unit for vacuum distillation, or a constant temperature distillation unit for vacuum cooling to an initial state thereof; and setting a vacuum distilling temperature for said constant temperature distillation unit for a degassed solution therein to boil and evaporate at said set vacuum distilling temperature in said unit; such that an equilibrium thermal cycling between evaporation and condensation can be maintained throughout said constant temperature distillation unit, and evaporation heat and condensate produced in said constant temperature distilling process are recovered and collected, respectively.

2. The constant temperature distilling process as claimed in claim 1, wherein said constant temperature distillation unit for vacuum cooling includes an evaporating vessel, into which constant-temperature degassed solution flows via

corresponding conduits and control valves at a predetermined flow rate, said evaporating vessel being connected to a condenser via a condensing tube for vapors produced by said evaporating vessel to flow into said condenser; a flow regulating valve provided on said condensing tube at a predetermined position for controlling the flow rate of vapors discharged from said evaporating vessel when said evaporating vessel is under a saturated vapor pressure at said set vacuum distilling temperature, and thereby maintaining said evaporating vessel at said desired saturated vapor pressure; a condenser, into and out of which hot circulating solution flows via corresponding conduits and control valves at a predetermined flow rate to absorb evaporation heat of vapors produced by said evaporating vessel and flown into said condenser, so that said hot circulating solution is heated to a higher temperature and said vapors are condensed into liquid, which is then discharged into and collected with a vacuum vessel; and a lower vessel and parts thereof being located below said evaporating vessel with a predetermined height difference existed between them for producing vacuums in said conduits, said evaporating vessel,

and said condenser through which said degassed solution, said vapors, or said condensed liquid flows.

3. The constant temperature distilling process as claimed in claim 1, wherein said constant temperature distillation unit for vacuum distillation includes an evaporating vessel; and a liquid-gas interface provided in said evaporating vessel, into and out of which a hot circulating solution flows via corresponding conduits and control valves at a predetermined flow rate, and said hot circulating solution providing evaporation heat through a heat transfer at said liquid-gas interface to evaporate said degassed solution in said evaporating vessel.

4. The constant temperature distilling process as claimed in claims 2 and 3, further comprising the step of vacuumizing said conduits, said evaporating vessel, and said condenser, through which said degassed solution, said vapors, or said condensed liquid flows, through implementing said drain-to-vacuum process using said degassed liquid to set said constant temperature distillation unit

for vacuum distillation to an initial state; sealing said conduits, said evaporating vessel, and said condenser; closing said flow regulating valve; filling said vacuumized evaporating vessel with said degassed solution to a predetermined liquid level; and finally, setting the vacuum distilling temperature for said evaporating vessel; wherein said vacuum distilling temperature being lower than temperatures of said degassed solution and said hot circulating solution flown into said evaporating vessel and said liquid-gas interface, respectively.

5. The constant temperature distilling process as claimed in claim 4, further comprising the steps of causing said degassed solution and said hot circulating solution to continuously flow into and out of said evaporating vessel and said liquid-gas interface, respectively, for said evaporating vessel to continuously produce vapors; opening said flow regulating valve when said evaporating vessel reaches said saturated vapor pressure at said vacuum distilling temperature, in order to allow said vapors produced by said evaporating vessel to flow into said condenser and thereby maintaining

said evaporating vessel at a stable saturated vapor pressure; and regulating said flow regulating valve to decrease a flow rate of said vapors being discharged when said degassed solution or said hot circulating solution providing evaporation heat has a flow-out temperature lower than said vacuum distilling temperature, or regulating said flow regulating valve to increase a flow rate of said vapors being discharged when said degassed solution or said hot circulating solution providing evaporation heat has a flow-out temperature higher than said vacuum distilling temperature.

6. The constant temperature distilling process as claimed in claim 5, wherein said equilibrium thermal cycling between evaporation and condensation is obtained by keeping said hot circulating solution providing evaporation heat at a temperature higher than that of said hot circulating solution recovering evaporation heat, so that said evaporating vessel has a working temperature higher than that of said condenser.

7. The constant temperature distilling process as claimed in claim 4, wherein said drain-to-vacuum

process is implemented only to partially vacuumize said evaporating vessel when said degassed liquid used in said drain-to-vacuum process is the same as said degassed solution.

8. The constant temperature distilling process as claimed in claim 5, further comprising the step of implementing said drain-to-vacuum process using said degassed solution for a second time to set said constant temperature distillation unit for vacuum distillation or vacuum cooling to the initial state and thereby resume said unit to a desired degree of vacuum when air remained in said degassed solution continuously accumulates in said conduits, said evaporating vessel, and said condenser, through which said degassed solution, said vapors, or said condensed liquid flows, to produce a pressure high enough to affect said vacuum distilling temperature set for said degassed solution.

9. A multi-stage vacuum distilling process for solution separation, comprising the steps of providing a tower-like multi-stage vacuum distilling system; setting said multi-stage vacuum

distilling system to an initial state thereof; performing a constant temperature distilling process, transferring of solutions, and recycling of a hot circulating solution to separate said solution and recover most part of heat energy for use repeatedly; and setting a vacuum distilling temperature for each stage of said multi-stage vacuum distilling system according to a temperature gradient of said hot circulating solution, so that said solution separation is achieved in the form of multi-stage vacuum distillation; wherein both said vacuum distilling temperature and a saturated vapor pressure corresponding thereto decrease from upper to lower stages in said multi-stage vacuum distilling system, allowing expanded ranges of usable vacuum distilling temperature and pressure as well as an increased number of vacuum distilling stages and more of said solution separable with one unit of energy.

10. The multi-stage vacuum distilling process for solution separation as claimed in claim 9, wherein said multi-stage vacuum distilling system includes fore-treatment equipment including heaters separately for heating a degassed solution and said

hot circulating solution to a set temperature; a plurality of constant temperature distillation units for vacuum distillation sequentially stacked one by one into a tower-like structure, in which a first stage, or the highest stage, is stacked over a second stage, the second stage is stacked over a third stage, etc., and in-flow conduits of one said constant temperature distillation unit at a lower stage are connected at a distal end to corresponding out-flow conduits of one said constant temperature distillation unit at an upper stage; and post-treatment equipment including vacuum vessels separately for collecting condensate and concentrated solution, a first heat exchanger for lowering a temperature of said hot circulating solution discharged at the last stage, a second heat exchanger for keeping said vacuum vessel for collecting said condensate at a set temperature, a common lower vessel and parts thereof for producing vacuums in said constant temperature distillation units for vacuum distillation, and a circulation pump for said hot circulating solution.

11. The multi-stage vacuum distilling process for

solution separation as claimed in claim 10, wherein said step of setting said multi-stage vacuum distilling system to an initial state thereof is performed by sequentially setting said constant temperature distillation units for vacuum distillation to their initial state one by one from lower to upper stages; and wherein in said step of setting a vacuum distilling temperature for each stage of said multi-stage vacuum distilling system according to a temperature gradient of said hot circulating solution, said temperatures set for said multiple stages of said vacuum distilling system decrease from upper to lower stages, so that a saturated vapor pressure at the temperature set for each vacuum distillation stage decreases from upper to lower stages.

12. The multi-stage vacuum distilling process for solution separation as claimed in claim 10, wherein said step of transferring solutions further includes the steps of causing said degassed solution heated to a set temperature to continuously flow into said evaporating vessel at each stage from upper to lower stages at a predetermined flow rate; allowing said degassed

solution to evaporate at each stage, so that said degassed solution has a concentration gradually increases from upper to lower stages or forms crystalline precipitate therein; collecting said concentrated solution discharged at the last stage with said vacuum vessel; subjecting said collected concentrated solution to further solute concentration using vacuum freezing and drying; filtering off any crystalline precipitate before said degassed solution flows into said evaporating vessel at the next lower stage, if there is crystalline precipitate in said evaporating vessel; and collecting said crystalline with a vacuum vessel.

13. The multi-stage vacuum distilling process for solution separation as claimed in claim 10, wherein said step of recycling a hot circulating solution further includes the steps of causing said hot circulating solution heated to a set temperature to continuously flow into and out of a liquid-gas interface at each stage from upper to lower stages at a constant flow rate to provide said degassed solution with required evaporation heat, so that the temperature of said hot circulating solution

decreases from upper to lower stages; using said first heat exchanger to lower the temperature of said hot circulating solution discharged at the last stage; and using said circulation pump to cause said hot circulating solution to continuously flow into and out of a condenser at each stage from lower to upper stages to absorb evaporation heat and thereby condense produced vapors to condensate, so that the temperature of said hot circulating solution increases from lower to upper stages; and allowing said hot circulating solution to flow back to said heater for heating said circulating solution.

14. The multi-stage vacuum distilling process for solution separation as claimed in claim 9, wherein said temperature gradient of said hot circulating solution is set according to a liquid-gas equilibrium curve of said degassed solution and then used to set the vacuum distilling temperature at each stage of vacuum distillation, enabling the forming of non-overlapped temperature ranges for different stages, and a trapezoidal temperature curve showing said temperature gradient of said hot circulating solution flowing through each

vacuum distilling stage.

15. A multi-stage vacuum cooling and freezing process for solution separation, which utilizes freezing and melting to produce condensate and may be used to assist in multi-stage vacuum distillation to increase the number of stages thereof, comprising the steps of providing and combining a tower-like multi-stage vacuum cooling system and a tower-like multi-stage vacuum freezing system; setting said multi-stage cooling and freezing systems to an initial state thereof; and performing transferring of solutions, a constant temperature distilling process, and a drain-to-vacuum and freezing process to produce ice crystals in a degassed solution; wherein said multi-stage vacuum freezing system using a low-temperature solution discharged at the lowest stage of said multi-stage vacuum cooling system as an initial solution needed to perform said multi-stage vacuum freezing to save energy needed for pre-cooling, and using vapors produced in multi-stage vacuum distilling and cooling processes as condensation heat required to melt said ice crystals produced in said degassed solution; low-temperature concentrated solution

and molten ice crystals produced through said multi-stage vacuum freezing process being used to cool a hot circulating solution discharged from the last stage of multi-stage vacuum distillation and to maintain the temperature of a vacuum vessel for collecting the condensate produced in said multi-stage vacuum distillation, enabling an expanded distilling temperature range and accordingly increased stages for the multi-stage distillation and increased yield of solution separable with one unit of energy.

16. The multi-stage vacuum cooling and freezing process for solution separation as claimed in claim 15, wherein said multi-stage vacuum cooling system includes a plurality of constant temperature distillation units for vacuum cooling sequentially stacked one by one into a tower-like structure, in which a first stage, or the highest stage, is stacked over a second stage, the second stage is stacked over a third stage, etc., with in-flow conduits of one said constant temperature distillation unit for vacuum cooling at a lower stage connected at a distal end to corresponding out-flow conduits of one said constant temperature

distillation unit for vacuum cooling at an upper stage; and a common lower vessel and parts thereof for said a plurality of constant temperature distillation units for vacuum cooling.

17. The multi-stage vacuum cooling and freezing process for solution separation as claimed in claim 16, wherein said multi-stage vacuum freezing system includes a plurality of freezing vessels sequentially stacked one by one into a tower-like structure, in which a first stage, or the highest stage, is stacked over a second stage, the second stage is stacked over a third stage, etc.; a liquid-solid interface provided in each of said freezing vessels for heat transfer; a condenser that enables releasing of condensation heat and evaporation heat from said degassed solution; a plurality of conduits and control valves thereof connecting said multi-stage vacuum freezing system to said multi-stage vacuum distillation system and said multi-stage vacuum cooling system to allow vapors produced through multi-stage vacuum distillation and multi-stage vacuum cooling to separately flow into said freezing vessel at each stage; a plurality of conduits and control valves

thereof cooperating with said lower vessel and parts thereof provided for said multi-stage vacuum cooling system to produce vacuums in said conduits and said freezing vessels through which said degassed solution, said produced vapors, or said condensate flow; and vacuum vessels separately for collecting molten ice crystals and low-temperature concentrated solution produced in said multi-stage vacuum freezing process.

18. The multi-stage vacuum cooling and freezing process for solution separation as claimed in claim 17, wherein said step of setting said multi-stage vacuum cooling system to an initial state thereof is performed by sequentially setting said constant temperature distillation units for vacuum cooling to their initial state one by one from lower to upper stages, and then setting a temperature of vacuum cooling for each stage of said multi-stage vacuum cooling system; and said temperatures set for said multiple stages of said vacuum cooling system decrease from upper to lower stages, so that a saturated vapor pressure at the temperature set for each vacuum cooling stage decreases from upper to lower stages.

19. The multi-stage vacuum cooling and freezing process for solution separation as claimed in claim 17, wherein said step of setting said multi-stage vacuum freezing system to an initial state thereof is performed by implementing the drain-to-vacuum process using a degassed liquid for all stages one by one from bottom to top to vacuumize said freezing vessels and said conduits through which said degassed solution, said vapors, or said condensate flow, and then seal said freezing vessels and said conduits.

20. The multi-stage vacuum cooling and freezing process for solution separation as claimed in claim 17, wherein said step of transferring solutions further includes the steps of fully filling said freezing vessel at the first stage with said low-temperature solution discharged at the last stage of said multi-stage vacuum cooling system; implementing the drain-to-vacuum and freezing process to produce ice crystals in said freezing vessel at the first stage of said multi-stage vacuum freezing system; causing each of said freezing vessels at a higher stage to completely discharge all said degassed

solution that has not yet frozen into ice crystals to said freezing vessel at the next lower stage or said vacuum vessel; guiding said vapors produced in said multi-stage vacuum distilling and cooling processes to said freezing vessel at the first stage of said multi-stage vacuum freezing system to melt said ice crystals produced in said freezing vessel; collecting said molten ice crystals with said vacuum vessel for molten ice crystals; implementing the drain-to-vacuum and freezing process in said freezing vessel at the next lower stage of said multi-stage vacuum freezing system or collecting said low-temperature concentrated solution with said vacuum vessel for low-temperature concentrated solution; and filtering off crystalline precipitate, if any, in said freezing vessel at an upper stage before said degassed solution flows into said freezing vessel at a lower stage; and collecting said crystalline with a vacuum vessel.

21. The multi-stage vacuum cooling and freezing process for solution separation as claimed in claim 17, wherein said drain-to-vacuum and freezing process further includes the steps of filling said

vacuumized freezing vessel having said liquid-solid interface provided therein with a predetermined amount of a low-temperature solution; implementing the drain-to-vacuum process to discharge said low-temperature solution at a predetermined speed to said vacuumized freezing vessel at the next lower stage or to said vacuum vessel; and using said condenser to continuously release said condensation heat and said evaporation heat in said freezing vessels for said solution in said freezing vessels to freeze into ice crystals on surfaces of said liquid-solid interfaces; said ice crystals forming at an increased speed when a vacuum volume in each of said freezing vessels increases, and ice crystals having even composition being finally formed on said liquid-solid interfaces in said freezing vessels.